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SANITARY SURVEY RAPID CREEK VICINITY OF RAPID CITY, SOUTH DAKOTA

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, KANSAS CITY, MISSOURI

1951

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SANITARY SURVEY, RAPID CREEK

VICINITY OF

RAPID CITY, SOUTH DAKOTA

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Water demand
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SANITARY SURVEY

RAPID CREEK

VICINITY OF

RAPID CITY, SOUTH DAKOTA

JANUARY 18-26, 1951

U.S. Public Health Service
Missouri Drainage Basin Office
Kansas City, Missouri

1951

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SANITARY SURVEY

RAPID CREEK

VICINITY OF

RAPID CITY, SOUTH DAKOTA

INTRODUCTION

At the request of the South Dakota Public Health Advisory Council a sanitary survey of Rapid Creek and an industrial waste survey were conducted in the Rapid City area on January 18-26, 1951. These surveys were made by the State Department of Health, Division of Sanitary Engineering with the assistance of the United States Public Health Service, Missouri River Drainage Basin Office, Kansas City, Missouri. Mr. R. J. Stapf, Chief of the Sewage Section, Division of Sanitary Engineering, State Department of Health, Pierre, South Dakota was in charge of this investigation. He was assisted by the following personnel:

Mr. J. L. Sorbel, District Engineer, State Department of Health, Rapid City, South Dakota;
Mr. Roy Anderson, Sanitarian, Pennington County Health Unit, Rapid City, South Dakota;
Mr. D. C. Kalda, Engineer, State Department of Health, Pierre, South Dakota;
Mr. Clarence Monday, Public Health Service, Division of Water Pollution Control, Kansas City, Missouri;
Mr. Clairborne W. Brink, Public Health Engineer, United States Public Health Service, Division of Water Pollution Control, Kansas City, Missouri.

All laboratory analyses were performed in the Water Pollution Control Laboratory of the State Department of Health, Division of Sanitary Engineering, Pierre, South Dakota

The purposes of the investigation were to determine and evaluate the sources of pollution of Rapid Creek in the vicinity of Rapid City, South Dakota and to determine the industrial waste loading of the Rapid City sanitary sewerage system. At the present time the City is enlarging the sewage treatment plant and has plans to enlarge it still further. The future additions are particularly concerned with the secondary treatment portion of the plant. Prior to initiating plans for such future construction it was desired to obtain information relative to the various industrial wastes contributed to the sanitary sewerage system.

LOCATION AND CHARACTER OF RAPID CREEK

Rapid Creek is a sparkling clean mountain stream flowing out of the Black Hills west of Rapid City. The Creek proceeds through Rapid City past such landmarks as Lockhart's Dam, Canyon Lake Park, South Dakota State School of Mines, and the municipal sewage treatment plant. Wastes from various sources, such as, private household wastes, storm sewers, cooling water, and treated sewage are discharged into the watercourse. From the municipal sewage

treatment plant located on the southeast edge of Rapid City, Rapid Creek flows in a southeasterly direction to discharge into the Cheyenne River.

WATER USES

The water from Rapid Creek is used for public swimming, cooling, stock watering, irrigation and fishing. An aesthetic value of the stream also exists because of Canyon Lake Park, private residences and tourist camps which have been constructed along the stream.

FIELD FINDINGS

Above Rapid City a highly desirable residental district is developing along Rapid Creek. One residence located on the road to Lockhart's Dam was observed discharging domestic wastes directly into the watercourse. Laboratory data obtained at the time of this survey did not indicate any appreciable amount of pollution entering at this point. The biochemical oxygen demand did not increase significantly to indicate sewage pollution. However, a significant increase in coliform was evidenced, indicating either domestic sewage or natural pollution from surface run-off. Since no precipitation had been recorded for the Rapid City area six months prior to this investigation it seems reasonable to suspect pollution of the Creek by domestic sewage.

Approximately 1.5 miles below Canyon Lake the City was constructing a new water infiltration gallery along Rapid Creek. As a result of this construction and accompanying dewatering operations a considerable amount of silt was being pumped into the stream. The field observation showed an apparent increase in turbidity below this point although its significance was not domonstrated in the laboratory. Because of the insignificant turbidity and the temporary nature of this source of pollution it was considered to be of little importance at this time.

As Rapid Creek passes through the City a close observation disclosed a cooling water line from a meat packing establishment and several large storm sewers discharging into the stream. The cooling water discharge, reportedly, carries no organic wastes. The storm sewerage system, although originally intended to rid the City of street washings and surface waters, is now suspected of carrying some sanitary sewage through unauthorized household connections. This suspicion is derived from a significant increase in the bacteriological index of the stream in this area. Although this increase of coliform organism could have come from surface drainage, the lack of rainfall in the Rapid City area seems to negate this as a plausible explanation.

At the lower end of the City is a feed lot which is operated in conjunction with a slaughter house. Stock water is obtained from the stream and drainage from the feed lot is to the watercourse.

A short distance below this feed lot is the site of the Rapid City Sewage Treatment Plant. This plant discharges treated municipal sewage into the stream.

DISCUSSION OF LABORATORY DATA

The laboratory data are presented in table 1 and are graphically portrayed in the attached graph. These data indicate that at the time of this

investigation the pollution introduced above Rapid City demonstrated little effect upon the Creek, except that the amount introduced would add its increment to the total pollutional load. Samples collected between stations 5 and 10, inclusive, demonstrates additional organic loading of the stream, probably caused by sanitary sewage in the storm sewerage system. Although the pollution introduced above the City and in the City was not causing any unsatisfactory conditions in the stream at this time, it is highly probable that at times nuisance conditions could develop. At sampling point number 12, located 1.5 miles below the municipal sewage treatment plant the Creek contained its greatest pollutional load. Both the biochemical oxygen demand and the coliform index were significantly great.

INDUSTRIAL WASTE SURVEY

Mr. Clairborne W. Brink, Public Health Engineer with the United States Public Health Service conducted this survey. Ten industries in Rapid City were contacted and their wastes were computed. These computations are presented in table 2 according to industry classifications. In this table the volume of waste is based on the gallons of water used per day and strength of the wastes is given in terms of population equivalents (P E.). On the basis of population equivalent the industrial wastes which are discharged into the municipal sewerage system is approximately equal to the wastes which would be contributed by an additional 6600 persons. This figure represents a 22% increase in the present population of Rapid City. From the field survey it was noted that some industries operated to maintain wastes at a minimum while others make little or no attempt to reclaim by-products.

CONCLUSIONS

In the Canyon Lake region, where private sewage was being discharged into the Creek, it was noted that the ground water table was high. This condition makes it difficult and undesirable to provide satisfactory soil absorption fields for septic tank effluent. Therefore, it necessitates the disposal of these wastes by some other means. At present these domestic wastes are being discharged into Rapid Creek which is unsatisfactory. Therefore, it seems advisable for the City to create a sanitary district to abate this condition.

The storm sewers discharging into Rapid Creek should be carefully scrutinized to locate any unauthorized sanitary sewer connections. This seems to be the only reasonable action to take in an attempt to discover the cause of the great increase in bacterial contamination as the Creek flows through town.

Lastly, each industry should be encouraged to initiate a waste conservation program to reduce the present load on the Rapid City Sewage Treatment Plant. Initiation of wastes conservation program by industry still should involve discharging the reduced organic or pollutional loads into the municipal sewers, however, cooling water and other sweet water may well be segregated and discharged through other outlets.

RAPID CREEK POLLUTION SURVEY

Listing of Sampling Points

Sample Number	Location
1	First bridge above Canyon Lake - 9.8 miles above sewage treatment plant.
1A	100 Yards above Jackson Springs - 9.3 miles above sewage treatment plant.
2	Bridge - Upper end of Canyon Lake - 8.8 miles above sewage treatment plant.
3	Bridge below spillway - 8.0 miles above sewage treatment plant.
4	Bridge below new infiltration gallery - 6.5 miles above sewage treatment plant.
5	Bridge on Deadwood Ave. - 4.5 miles above sewage treatment plant.
6	Bridge on Oshkosh Ave. - 3.7 miles above sewage treatment plant.
7	Bridge on West Boulevard - 3.2 miles above sewage treatment plant.
8	Railroad bridge between 2nd and 3rd streets - 2.5 miles above sewage treatment plant.
9	Bridge on Maple Ave. - 2.0 miles above sewage treatment plant.
10	Dam North of School of Mines - 1.0 miles above sewage treatment plant.
11	Bridge - 0.5 miles above sewage treatment plant.
12	Bridge - 1.5 miles below sewage treatment plant.
13	Bridge - 5.0 miles below sewage treatment plant.
14	Bridge - 7.0 miles below sewage treatment plant.

RAPID CREEK POLLUTION SURVEY

TABLE 1

Sample Collectors: Stapf & Kalda
Analyser : Monday & S.D. Party

Date	Sample Number	Time	T-°C.	pH	Turb.	D.O		B.O.D.				Coli/100ML	Remarks
						D.O.	%Sat.	Initial	Final	Dil.	BOD		
1-16-51		9:35	1	8.0	<25	12.2	86	8.3	6.9	100%	1.4	30	Open water
1-23-51	1	8:45	1		<25	12.2	86	8.9	6.4	100%	2.5	230	" "
1-25-51		9:35										430	" "
1-18-51		12:20	2	7.9	<25	12.5	90	9.2	6.3	100%	2.9	<30	Open water
1-23-51	1A	9:00	0		<25	12.6	86	8.9	7.7	100%	1.2	91	" "
1-25-51		9:40										230	" "
1-18-51		9:50	7	7.8	<25	9.6	79	7.9	6.5	100%	1.4	91	Open water
1-23-51	2	9:10	5		<25	9.9	77	8.2	6.2	100%	2.0	91	" "
1-25-51		9:43										750	" "
1-18-51		10:05	5	8.0	<25	11.3	88	7.9	6.4	100%	1.5	150	Open water
1-23-51	3	9:20	3		<25	11.5	85	9.7	7.8	100%	1.9	91	" "
1-25-51		9:45										230	" "
1-18-51		10:20	4	8.0	<25	11.5	88	8.0	6.3	100%	1.7	<30	Open water
1-23-51	4*	9:30	2		210	11.9	86	9.6	7.2	100%	2.4	36	" "
1-25-51		9:50										36	" "
1-18-51		10:30	3	8.0	<25	11.8	88	7.4	5.5	100%	1.9	230	Open water
1-23-51	5	9:40	1		<25	12.4	87	9.1	7.7	100%	1.4	210	" "
1-25-51		9:55										930	" "
1-16-51		10:40	3	7.9	<25	12.0	89	7.7	6.3	100%	1.4	2,300	Open water
1-23-51	6	9:50	1		<25	12.7	89	8.9	7.2	100%	1.7	2,300	" "
1-25-51		9:58										2,300	" "
1-18-51		11:10	3	8.0	<25	12.4	92	8.0	6.2	100%	1.8	2,300	Open water
1-23-51	7	10:10	1		65	12.9	91	9.3	6.1	100%	3.2	750	" "
1-25-51		10:00										230	" "

* Waste water carrying silt being pumped to creek from infiltration gallery

Rapid Creek Pollution Survey, Table 1 (continued)

Date	Sample Number	Time	T-°C.	pH	Turb.	D.O.	D.O. %Sat.	B.O.D. Initial	B.O.D. Final	B.O.D. Dil.	B.O.D. BOD	Coli/100 ml	Remarks
1-18-51		11:25	3	8.1	<25	13.1	97	7.3	4.7	100%	2.6	110,000	Open water
1-23-51	8	10:30	1		40	12.7	89	9.0	6.1	100%	2.9	3,600	" "
1-25-51		10:05										910	" "
1-18-51		11:30	3	8.2	<25	13.3	99	7.4	5.3	100%	2.1	110,000	Open water
1-23-51	9	10:40	1		45	13.2	93	8.0	4.9	100%	3.1	<3,000	" "
1-25-51		10:08										4,300	" "
1-18-51		12:45	3	8.1	<25	12.9	96	7.9	5.9	100%	2.0	430	Open water
1-23-51	10	10:50	1		<25	12.7	89	8.7	6.8	100%	1.9	2,300	" "
1-25-51		10:12										7,500	" "
1-18-51		1:00	3	8.1	<25	13.1	97	8.2	6.4	100%	1.8	750	Open water
1-23-51	11	11:00	1		30	12.7	89	8.6	5.2	100%	3.4	46,000	" "
1-25-51		10:16										2,300	" "
1-18-51		1:30	3	8.0	30	11.5	85	8.17	5.8	20%	11.9	230,000	Open water
1-23-51	12	11:05	0		<25	12.5	86	7.8	4.65	50%	6.3	43,000	" "
1-25-51		10:20										150,000	" "
1-18-51		1:45	3	8.1	<25	12.4	92	8.76	6.4	40%	5.9	9,300	Open water
1-23-51	13	11:15	0		<25	12.8	87	8.2	4.3	100%	3.9	9,300	" "
1-25-51		10:26										43,000	" "
1-18-51		2:00	1	8.0	<25	13.3	94	9.0	4.4	100%	4.6	9,300	Partial ice
1-23-51	14	11:20	0		<25	12.5	86	8.2	4.4	100%	3.8	75,000	coverage
1-25-51		10:31										43,000	

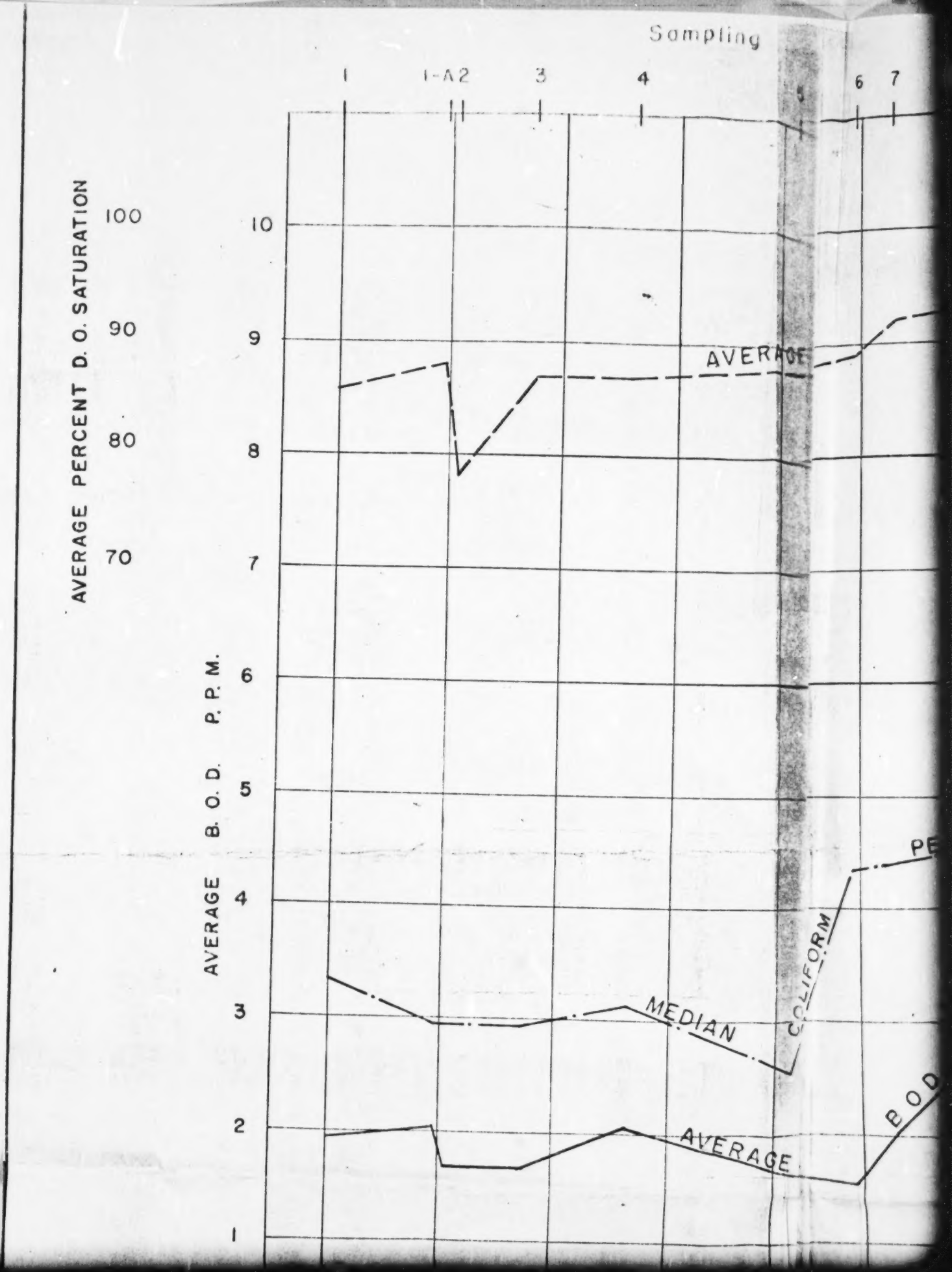
RAPID CITY, SOUTH DAKOTA

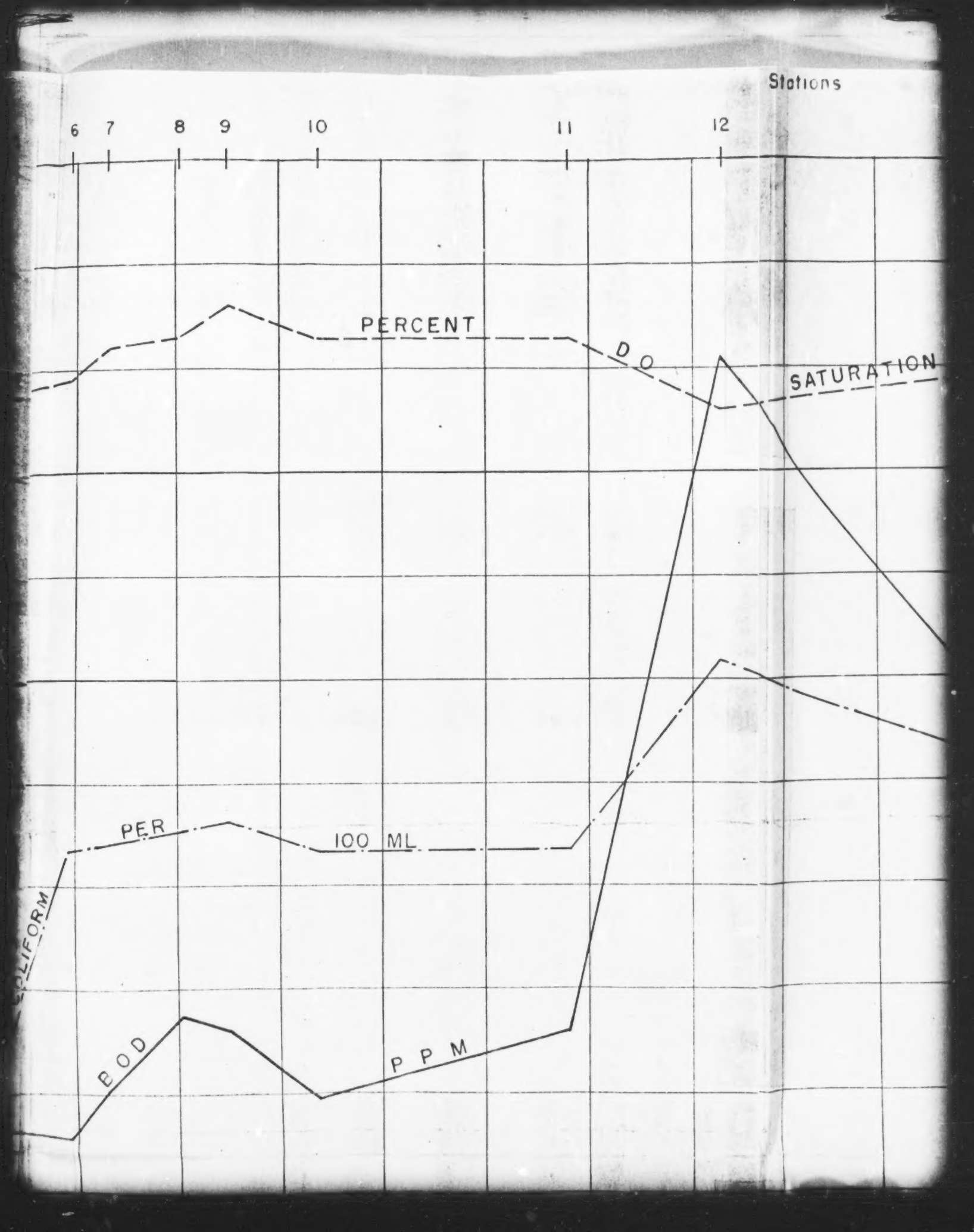
INDUSTRIAL WASTE TO SEWAGE PLANT

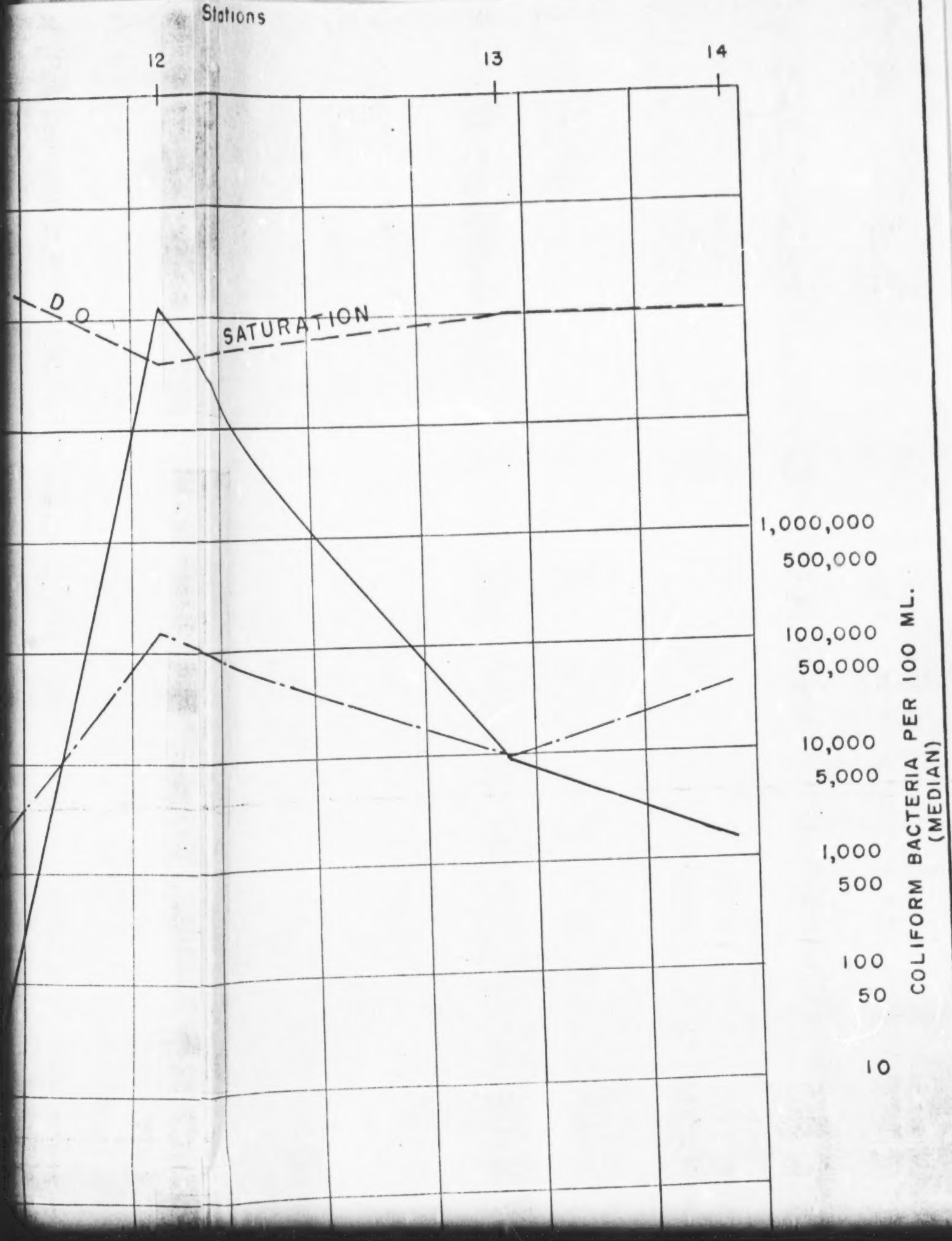
TABLE 2

Type of Industry	Average Gallon Water/day	Estimated P. E. Based upon B.C.D.
Creamery and Dairy	112,200	770
Packing house and poultry establishments	9,000*	5,070
Laundries	47,050	760
Totals	168,250	6,600

* Incomplete data on water consumption


Sampling
1
1-A2
3
4
5
6
7
AVERAGE PERCENT D. O. SATURATION
100
90
80
70
AVERAGE B. O. D. P. P. M.
10
9
8
7
6
5
4
3
2
1
AVERAGE
MEDIAN
COLIFORM
AVERAGE


Stations
6
7
8
9
10
11
12
PERCENT
D O
SATURATION
PER
100 ML
COLIFORM
B O D
P P M


Stations
12
13
14
D O
SATURATION
1,000,000
500,000
100,000
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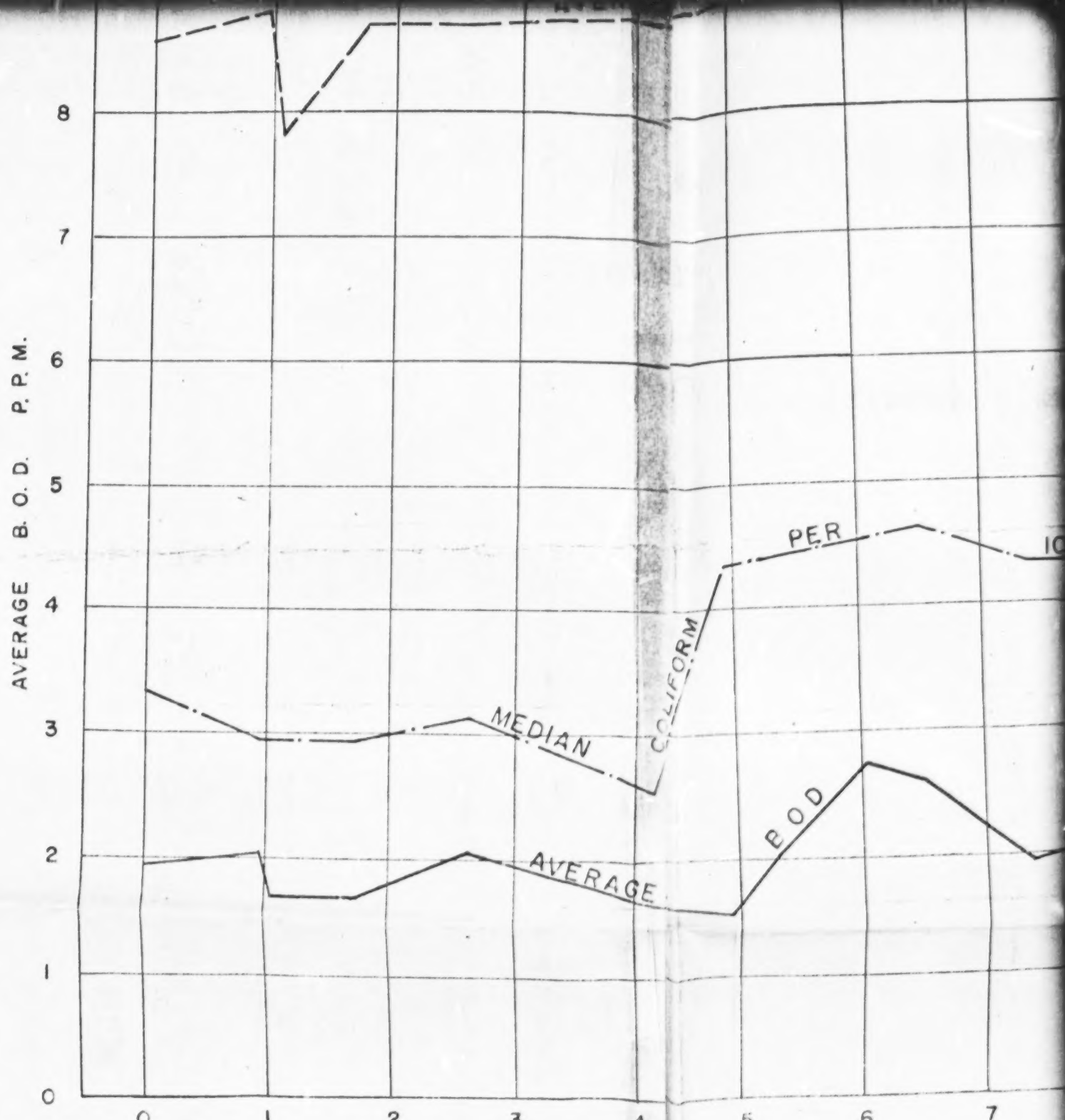
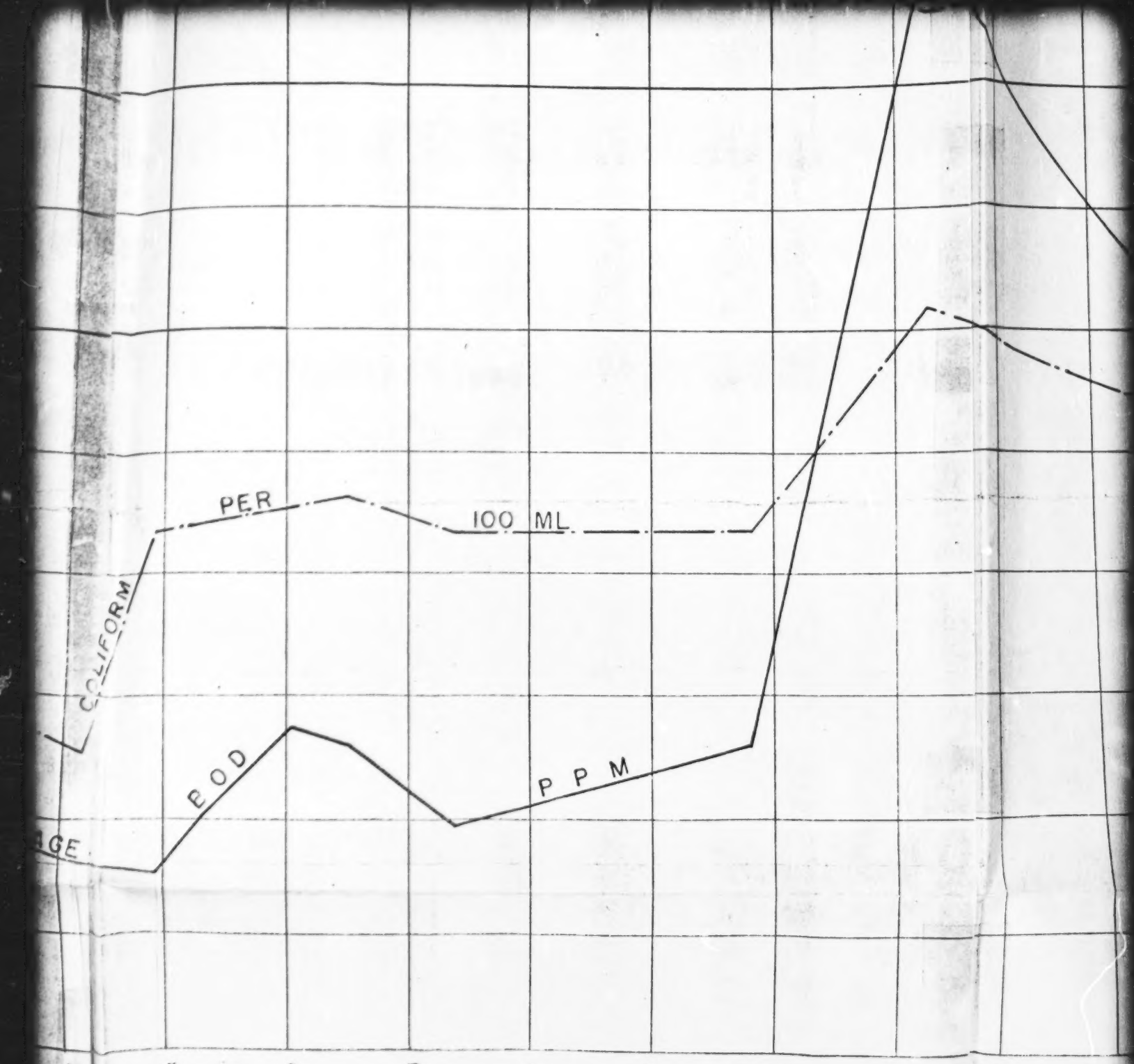
5,000
1,000
500
100
50
10
COLIFORM BACTERIA PER 100 ML.
(MEDIAN)



RIVER

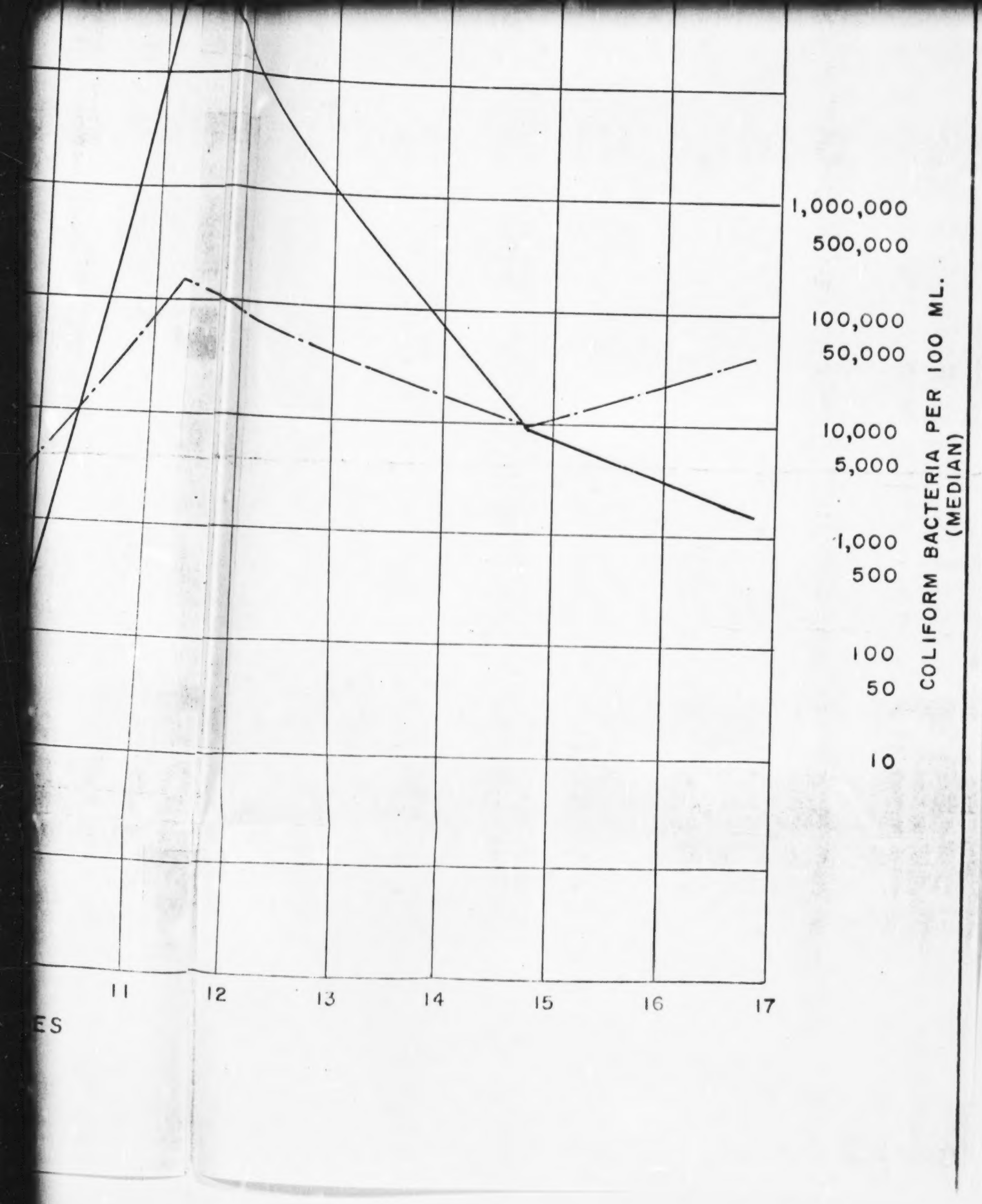
RAPID GREE
SU

Rapid City,



RAPID CREEK POLLUTION SURVEY

Rapid City, South Dakota


1,000,000
500,000
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10
COLIFORM BACTERIA PER 100 ML.
(MEDIAN)
11
12
13
14
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17

ES